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## BIOLOGICAL PHILOSOPHY.

*Creative Evolution.* By Prof. H. Bergson. Authorised translation by Dr. A. Mitchell. Pp. xv+425. (London: Macmillan and Co., Ltd., 1911.) Price 10*s.* net.

NOT a few of the great philosophers of the past were expert students of science, especially of mathematics and physics. We think at once of men like Descartes, Leibnitz, and Kant, to mention three whose periods are in almost continuous chronological sequence. The widening of the field of knowledge and submission to a correlated division of labour have made it less possible in these later days for a man to be a mathematician in the morning and a metaphysician at night, but the tradition of an alliance between the two disciplines has not been lost. For to a greater extent than is generally recognised there have been of recent years, in the ranks of the philosophers, men having not merely—though that is much—an intelligent sympathy with scientific work, but familiarity therewith and ability to offer competent criticism. We think, for instance, of men like the late Prof. William James, Prof. Royce, Prof. James Ward, and Prof. A. E. Taylor. Within the same period, too, we have seen one department of science after another making its definite contribution to philosophy. Now a mathematician, and again an embryologist, has been as a Saul among the prophets. We think, for instance, of Mr. Bertrand Russell, Dr. Hans Driesch, and Prof. Lloyd Morgan. It seems then that the time is ripening for a closer cooperation of philosophy and science, and the man of the time is Henri Bergson.

Metaphysician as he is, M. Bergson seems to be equally at home with mathematical and biological concepts, and he appreciates the aim of science with a rare sympathy. He recognises that metaphysics, in its endeavour to discover the general conditions of a complete and consistent formulation of experience, may be of great service to science, but he is equally clear that, in forming its coherent conception of the whole scheme of things, metaphysics must utilise the materials which the sciences furnish. It is indeed one of the outstanding features of his "Creative Evolution" that its author insists on finding in a more complete appreciation of the manifoldness of nature a basis for his new philosophy of life.

One of the main motives of the essay before us is the conviction that *theory of knowledge* and *theory of life* are inseparable inquiries. They must join each other and "push each other on unceasingly." In their common enterprise, "they would dig to the very root of nature and of mind."

"For the false evolutionism of Spencer—which consists in cutting up present reality, already evolved, into little bits no less evolved, and then recomposing it with these fragments, thus positing in advance everything that is to be explained—they would substitute a true evolutionism, in which reality would be followed in its generation and its growth."

The book is divided into four chapters, the sequence of which the author explains. In the first chapter "we try on the evolutionary progress the two ready-made garments that our understanding puts at our disposal," mechanism and finalism; neither will fit, but finalism "might be recut and resewn, and in this new form fit less badly than the other." In the second chapter, to get beyond the concepts which the understanding puts at our disposal, the author reconstructs the main lines of evolution along which life has travelled—to vegetative torpor, to instinct, to intelligence. Besides the line of evolution which ends in man, there are others which "also express something that is immanent and essential in the evolutionary movement." Perhaps certain powers within us that are complementary to conceptual and logical thought, "will become clear and distinct when they perceive themselves at work, so to speak, in the evolution of nature." The third chapter is an effort to bring back the intellect to its generating cause, "which we then have to grasp in itself and follow in its movement." "A fourth and last part is meant to show how our understanding itself, by submitting to a certain discipline, might prepare a philosophy which transcends it."

Prof. Bergson's book, the translation of which reflects the highest credit on Dr. Arthur Mitchell, has been called both brilliant and profound, and it is too big for us to praise. We wish to say, however, that we have read it three times with increasing enjoyment and gratitude. When we have read it other three times we may perhaps understand it more perfectly, for it is useless to pretend that it is easy. The style is so brilliant and picturesque, the play of the sword is so fascinating, there is such abundance of interesting illustration that the pages slip easily past, yet for the student of organic evolution, seeking for fresh light, the thought often seems very abstract and subtle. For example, specialists may find no particular difficulty in the conception of "durée," which is so essential to the argument, but that has not been our experience. For the pages of NATURE it may be most suitable that we should leave the more purely philosophical part of the book alone, and confine ourselves to a few of the salient biological ideas, *e.g.* of the organism as a historic being, and of evolution as a succession of creations—expressions of sustained "effort."

One of the pivots of the essay is its conception of the organism, from which, as it seems to us, modern biology has something to learn, something to translate into its own universe of discourse. Bergson dwells on the likeness between the life of the organism and our own personal experience. We change without ceasing and the organism continually exhibits its characteristic metabolism. But both have the mysterious quality of "durée"—a word so difficult to translate, for Bergson means more than duration in the merely physical and chronological sense; he means "the continuous progress of the past which gnaws into the future and which swells as it advances." "Our personality shoots, grows, and ripens without ceasing. Each of its moments is something new added to what was

before. We are creating ourselves continually." So of an organism it may be said that "its past, in its entirety, is prolonged into its present, and abides there, actual and acting."

"Continuity of change, preservation of the past in the present, real duration—the living being seems, then, to share these attributes with consciousness. Can we go further and say that life, like conscious activity, is unceasing activity?"

Bergson answers this question by an emphatic affirmative. The spontaneity of life is manifested by a continual creation of new forms.

Many biologists and others have previously expounded the idea of the organism as a historic being, but Bergson has given it a new vividness. "Wherever anything lives, there is, open somewhere, a register in which time is being inscribed." For it is of the essence of Bergson's thinking that time has an effective action and a reality of its own.

"We perceive duration as a stream against which we cannot go. It is the foundation of our being, and, as we feel, the very substance of the world in which we live."

"The evolution of the living being, like that of the embryo, implies a continual recording of duration, a persistence of the past in the present, and so an appearance, at least, of organic memory."

It is this conception, in part, which leads Bergson to reject radical mechanism with some emphasis, and, for that matter, radical finalism as well, though he ends with leaving us with a theory that partakes of finalism to a certain extent.

Prof. Bergson thinks of life as

"the continuation of one and the same impetus, divided into divergent lines of evolution. Something has grown, something has developed by a series of additions which have been so many creations." "Evolution has taken place through millions of individuals, on divergent lines, each ending at a crossing from which new paths radiate, and so on indefinitely."

He believes that the essential causes working along these diverse roads are "of psychological nature." It is to be expected therefore that "they should keep something in common in spite of the divergence of their effects."

"Something of the whole, therefore, must abide in the parts; and this common element will be evident to us in some way, perhaps by the presence of identical organs in very different organisms."

It is this idea which leads Prof. Bergson to devote particular attention to the phenomenon of convergence in evolution, to the occurrence, for instance, of closely similar eyes in molluscs and in vertebrates—eyes which differ greatly in development, and must have had a quite independent evolution.

"What likelihood is there that, by two entirely different series of accidents being added together, two entirely different evolutions will arrive at similar results?"

Of course, the conventional Darwinian and Lamarckian interpretations are carefully considered.

"But such similarity of the two products would be natural, on the contrary, on a hypothesis like ours: even in the latest channel there would be something of the impulsion received at the source. *Pure mechanism, then, would be refutable, and finality, in the special sense in which we understand it, would be demonstrable in a certain aspect, if it could be proved that life may manufacture the like apparatus, by unlike means, on divergent lines of evolution; and the strength of the proof would be proportional both to the divergency between the lines of evolution thus chosen and to the complexity of the similar structures found in them.*"

This is one of the ingenious arguments of this brilliant essay, but we doubt if it would convince anyone against his will.

Prof. Bergson considers various theories of evolution, which he regards as each true in its way. The neo-Darwinians are probably right in teaching that the essential causes of variation are the differences in the germs borne by the individual, but probably wrong in regarding (or if they regard) these differences as purely accidental and individual. Eimer was probably right to some extent in his idea of variation continuing from generation to generation in definite directions, but probably wrong in his claim that combinations of physical and chemical causes are enough to secure the result. The neo-Lamarckians are probably right in insisting on causes of a psychological nature, but they are probably wrong in thinking merely of the conscious effort of the individual and in assuming the regular transmission of acquired characters. The author's own position may be gathered from the following sentences:—

"A hereditary change in a definite direction which continues to accumulate and add to itself so as to build up a more and more complex machine, must certainly be related to some sort of effort, but to an effort of far greater depth than the individual effort, far more independent of circumstances, an effort common to most representatives of the same species, inherent in the germs they bear rather than in their substance alone, an effort thereby assured of being passed on to their descendants."

So we come to the idea of—

"an *original impetus* of life, passing from one generation of germs to the following generation of germs through the developed organisms which bridge the interval between the generations. This impetus, sustained right along the lines of evolution, among which it gets divided, is the fundamental cause of variations, at least of those that are regularly passed on, that accumulate and create new species. In general, when species have begun to diverge from a common stock, they accentuate their divergence as they progress in their evolution. Yet, in certain definite points, they may evolve identically; in fact, they must do so if the hypothesis of a common impetus be accepted."

This remains too shadowy for the working naturalist, but it is a fresh attempt to express what must some day become clearer, the essential thought of Lamarck, of Goethe, of Robert Chambers, of Samuel Butler, and of later vitalists—the idea of variations as intrinsic self-expressions of the organism.

Another cardinal idea of Prof. Bergson's book is that the evolution of life has taken a number of divergent directions, leading to quite different goals. It is neither a series of adaptations to accidental circumstances, as the mechanistic view sees it, nor the

realisation of a plan, as the finalist view would have it. A plan is given in advance, but evolution is a creation unceasingly renewed, a development of an original impetus in various directions. Two of these directions are represented by the world of plants with their fixity and insensibility, and the world of animals with their mobility and awakened consciousness.

"But the waking could be effected in two different ways. Life, that is to say, consciousness launched into matter, fixed its attention either on its own movement or on the matter it was passing through; and it has thus been turned either in the direction of intuition or in that of intellect."

Intuition could not go very far, and shrank into instinct. Intelligence became more and more free, and "it can turn inwards on itself, and awaken the potentialities of intuition which still slumber within it." While Bergson shows very finely how the plant may sometimes rouse itself from its torpor and the animal sink into vegetativeness, how instinct may be mingled with intelligence, and intelligence penetrated by instinct, yet his definite conclusion is that the differences between vegetative torpor, instinct, and intelligence are differences of kind.

"*The cardinal error which, from Aristotle onwards, has vitiated most of the philosophies of nature, is to see in vegetative, instinctive and rational life, three successive degrees of the development of one and the same tendency, whereas they are three divergent directions of an activity that has split up as it grew.*"

And it is from this that the author passes to his even more important conclusion that while intelligence guides us into matter and delivers to us the secret of physical operations, it is instinct—which is sympathy—that will give us the key to vital operations.

"Intelligence goes all round life, taking from outside the greatest possible number of views of it, drawing it into itself instead of entering into it. But it is to the very inwardness of life that *intuition* leads us—by intuition I mean instinct that has become disinterested, self-conscious, capable of reflecting upon its object and of enlarging it indefinitely."

Thus while nature-poetry is in no sense biology, it may be a very important complement.

J. A. T.

## TIDES AND ORBITS.

*Scientific Papers.* By Sir George Howard Darwin, K.C.B., F.R.S. Vol. iv., Periodic Orbits and Miscellaneous Papers. Pp. xviii+592. (Cambridge: University Press, 1911.) Price 15*s.* net.

IN this fourth volume Sir George Darwin has for the present completed the task of editing his papers, a task which he commenced four years ago on the invitation of the syndics of the Cambridge University Press. If we may judge from the fact that nine papers in the present volume have appeared since the publication of the work was started there is reason to hope that a supplementary volume will be needed before many years are past. That volume when it comes will have to contain, if it is to be consistent with former volumes, pioneer investigations of a high order in some difficult branch of applied mathematics. To one who desires to speculate along what line Sir George Darwin's future work is likely to take him the present volume is of especial interest. For in the papers classed under the head "Miscellaneous Papers in Chronological Order" will be found several early papers containing the germ of much of the later more important work. Several of these papers (notably 11, 12, 13) would appear to be by-products of larger investigations which were already (we judge from the chronological list of papers) well in hand when these investigations were published. But the paper "On the perturbation of a comet in the neighbourhood of a planet," which was followed after an interval of four years by the historic investigations on periodic orbits, does look like the first attempt along a new and fruitful line of investigation. In fact, though differing in scope and nature from the larger work, the small paper to which we have just referred might quite fairly, from a historic point of view, have been placed in the section containing the periodic orbits papers, as a preliminary piece of research. This section is the most important part of the volume under review, and we must discuss it in some detail.

In the introduction to the well-known memoir in the *Acta Mathematica,* the author speaks of the prodigious amount of numerical work involved in his attack on the problem of periodic orbits. He adds:—

"It is not for me to say whether the enormous labour I have undertaken was justifiable in the first instance; but I may remark that I have been led on, by the interest of my results, step by step, to investigate more, and again more cases. Now that so much has been attained I cannot but think that the conclusions will prove of interest both to astronomers and mathematicians."

Recent successful applications to problems of celestial astronomy of what are to a large extent Sir George Darwin's methods would alone justify his heavy work. But quite apart from these applications the paper has great intrinsic value. The important stability discussion and the useful account of the method of mechanical quadratures practically developed by the author both serve a very useful purpose to the student. The presence of a paper by Mr. S. S. Hough, his Majesty's astronomer at the Cape, is a valuable addition to the section. It not only serves to bridge over the gap between Darwin's first and third papers and to supply an important addition to the theory of the subject, but it also supplies an account of the orbit work from a different point of view from that of the author. It may not unfairly be compared to Schwarzschild's account of Poincaré's work on revolving bodies, and its presence alongside Darwin's papers is of great value. It should be added that the illustrations have been well reproduced, and that from an interesting appendix some idea may be gleaned of the heavy computing work involved in these researches. Here it seems not unreasonable to refer to Sir George Darwin's generous and thoughtful appreciation of his great co-worker's investigations in his own field. His address on presenting the gold medal of the Royal Astronomical Society to M. Poincaré is full of interest. This, with his two British Association addresses, will form the chief item of interest in this volume to the non-mathematical reader. We can only glance at two points of interest here.